Utilizing TRMM to Analyze Sea Breeze Thunderstorm Patterns During El Nino Southern Oscillations and their Effects Upon Available Fresh Water for South Florida Agricultural Planning and Management

Water is in high demand for farmers regardless of where you go. Unfortunately, farmers in southern Florida have fewer options for water supplies than public users and are often limited to using available supplies from surface and ground water sources which depend in part upon variable weather patterns. There is an interest by the agricultural community about the effect weather has on usable surface water, however, research into viable weather patterns during La Nina and El Nino has yet to be researched. Using rainfall accumulation data from NASA Tropical Rainfall Measurement Mission (TRMM) satellite, this project's purpose was to assess the influence of El Nino and La Nina Oscillations on sea breeze thunderstorm patterns, as well as general rainfall patterns during the summer season in South Florida. Through this research we were able to illustrate the spatial and temporal variations in rainfall accumulation for each oscillation in relation to major agricultural areas.

The study period for this project is from 1998, when TRMM was first launched, to 2009. Since sea breezes in Florida typically occur in the months of May through October, these months were chosen to be the months of the study. During this time, there were five periods of El Nino and two periods of La Nina, with a neutral period separating each oscillation [Figure 1]. In order to eliminate rainfall from systems other than sea breeze thunderstorms, only days that were conducive to the development of a sea breeze front were selected.

Four watersheds were chosen as our focal points, given that these contained the most hectares of agricultural land. This was found by creating a Land Classification map using Landsat 5 TM images [Figure 2]. Using kriging to interpolate tabular data, rasters were created showing monthly Sea Breeze rainfall accumulation. Zonal statistics were

run on each of the total monthly rainfall rasters and sea breeze thunderstorm monthly rainfall rasters. A program written in Python was used to report the mean rainfall accumulation in each zone. It looped through each raster and used the “Zonal Statistics as a Table” tool in ArcMap to create a table for each raster. The program then reported the sum for each zone, for each month, in a text file.

Monthly rainfall, monthly sea breeze rainfall, and monthly rainfall anomalies were correlated with the Oceanic Nino Index and the Southern Oscillation Index. These correlations were then used to create maps in ArcGIS to display rainfall accumulations and distribution during El Nino, La Nina, and Neutral periods [Figure 3 & 4]. Accuracy assessments were then performed for the TRMM rainfall data, which were compared to ground-radar data.

Through the use of TRMM data, this research was able to conclude that most of the agricultural areas in South Florida were located on the fertile land surrounding Lake Okeechobee. Of the agricultural areas, the Atlantic watershed was the only region in which the monthly rainfall anomalies showed any correlation. Although the correlation was weak, it was still statistically significant. No other watershed’s anomalies showed a significant correlation [Figure 5]. This research also determined that during La Nina months, less sea breeze days and more disturbed days were found to occur compared to El Nino and neutral months. Overall, neither sea breeze rainfall patterns nor total rainfall patterns in South Florida’s main agricultural areas were found to be strongly influenced by the El Nino Southern Oscillation